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Water quality in the eastern Iowa basins

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Abstract
This article summarizes major findings about nutrients in surface and groundwater in the eastern Iowa basins (see map) between 1996 and 1998. The data were collected as part of the U.S. Geological Survey (USGS) National Water-Quality Assessment Program (NAWQA). Water quality is discussed in terms of local and regional issues and compared with conditions found in all 36 National NAWQA study areas assessed to date. Findings are explained in the context of selected national U.S. Environmental Protection Agency (EPA) benchmarks, such as those for drinking water quality and the protection of aquatic organisms.

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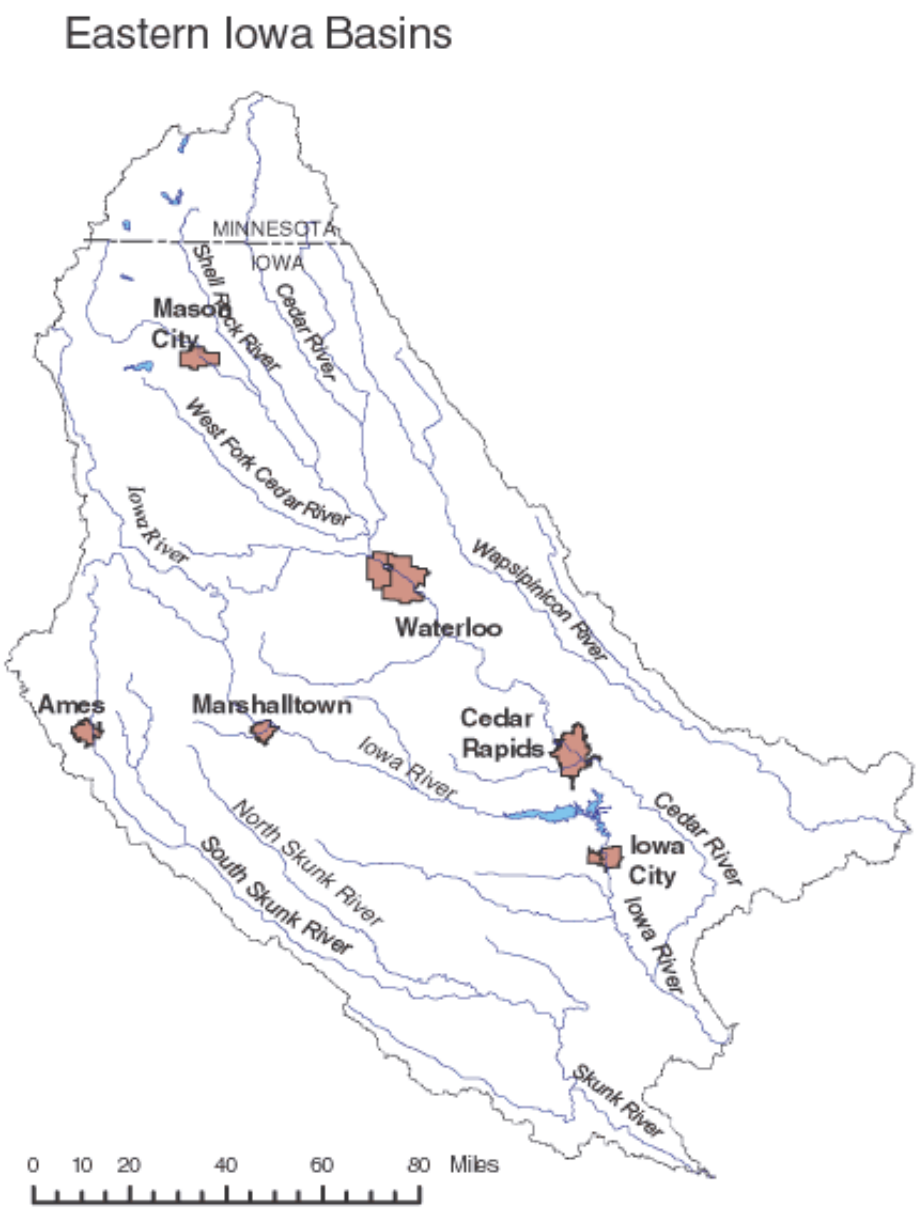
The Eastern Iowa Basins Study Unit includes the Wapsipinicon, Cedar, Iowa, and Skunk River basins and covers approximately 19,500 square miles in eastern Iowa and southern Minnesota. More than 90 percent of the land in the study unit is used for agricultural purposes. Forested areas account for only 4 percent of the land area.



Stream and river highlights

Nitrogen (N) and phosphorus (P) concentrations in streams in the Eastern Iowa Basins Study Unit rank as some of the highest in the Corn Belt, as well as the nation, and were higher than the drinking water standard in many samples. These conditions reflect the intensive use of the land for growing crops and dense populations of livestock in some basins.

- Nitrate-N concentrations in 22 percent of the stream samples exceeded the U.S. EPA drinking water standard of 10 mg/liter (or parts per million). The standard was most frequently exceeded during June. Although many of the streams sampled are not currently used for drinking water supplies, the Cedar and Iowa rivers are the direct or indirect source for Cedar Rapids and Iowa City--two of the largest cities in the study area.
- The highest nitrate-N concentrations occurred in medium-sized streams draining basins with the most intensive row-crop agriculture and in a stream draining a basin with both intensive row-crop agriculture and dense concentrations of large-scale animal feeding operations. Nitrate-N concentrations in these streams exceeded 10 mg/liter in almost

50 percent of the samples. Conversely, nitrate-N concentrations were lowest in basins that had greater percentages of pasture, grassland, and forest.
- Total P concentrations frequently exceeded the 0.1 mg/liter EPA recommended goal to minimize algal growth in rivers. Total P concentrations were greatest in streams and rivers that drain basins with more highly erodible soils and in large river basins that contain the largest cities and towns in the study unit.
- The large amounts of N and P that are transported to the Mississippi River from the study unit represent an economic loss to farmers and a potential environmental threat to downstream waters. The estimated annual loss of 17 to 41 lb/acre N and 1.2 to 1.5 lb/acre P represents a potential loss in crop yield or the cost of additional fertilizer needed to compensate for that flushed from the fields. Nutrients transported to the Mississippi River probably reach the Gulf of Mexico, where they contribute to eutrophication and hypoxia.
- Riparian buffer zones influence the quality of water in streams and rivers. Biological communities respond to tree density in riparian buffer zones. Invertebrates (benthic macroinvertebrates) associated with high water-quality streams increased with increased numbers of trees. In contrast, streams that were not shaded by trees contained large algal growths, which are correlated with eutrophication.

Ground water highlights

Compared with surface water, groundwater in the eastern Iowa basins had substantially lower nutrient concentrations.

- Nitrate-N concentrations generally decreased with depth in the alluvial aquifers. Biological denitrification may result in decreased nitrate-N concentration with depth, but it is also possible that the deeper water infiltrated during past years when less fertilizer was used for crop production.
- Nutrients move from groundwater to streams by natural drainage and tile lines. Nitrate-N concentrations in 24 of 25 medium-sized streams exceeded 10 mg/liter during the sampling period in May 1998, when streamflow originated primarily from groundwater discharge. Nitrate-N concentrations consistently exceeded 10 mg/l in water from a selected tile line draining to the Iowa River.

For more information on the Eastern Iowa Basins Report, go to the USGS NAWQA website [1] or contact USGS State Representative, U.S. Geological Survey, Water Resources Division, P.O. Box 1230, 400 South Clinton St., Rm. 269, Iowa City, IA 52244, E-mail: dc_ia@usgs.gov [2]

Some of the information in this article was taken from Water Quality in the Eastern Iowa Basins, Iowa and Minnesota, 1996-98 [3]. U.S. Department of the Interior-U.S. Geological Survey Circular 1210.

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